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INSTRUMENT FOR DETERMINING THE SMOOTHNESS OF PAPER

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The proposed instrument is intended to determine the smoothness of paper and can be used at pulp and paper industry enterprises.

There are known devices for determining the smoothness of paper by measuring the outflow time of air between the surface of a polished stage and the tested paper sample, which consists of a stage, vacuum chamber connected to a pump by an air line, and a timing device.

The goal of the invention is to stabilize the set vacuum in the chamber and automate the measurement of the air flow time. This is achieved by connecting the vacuum chamber in the proposed instrument to a pneumoelectric vacuum gauge and an electric timing device.

The figure shows the electropneumatic circuit diagram of the proposed device.

The instrument is connected to power by toggle switch T_1, which supplies power to the circuit of incandescent lamp LS_1, and time relay, and actuates signal lamp LS_2. The sample is placed on clamp stage 1 and switch S_1 is turned to the "sample clamped" position.

The circuit for feeding the winding of relay P_3 is closed by contacts S_{2-1}, the relay is actuated, its contacts $5P_3$ block contacts S_{2-1} of the switch, after which the switch is turned to position "O."

Contacts $1P_3$ close the circuit of the winding of relay P_5, which supplies power by its contacts $1P_5$, $2P_6$ and $3P_3$, motor AD_1 of vacuum pump NV_1. The reduced pressure created in the working cavity of clamp mechanism 2 presses the sample to the polished glass at a specific force. The contacts in the "sample clamped" position of the range switch S_1 duplicate the operation of contacts S_{2-2}, while in the "sample free" position the switches close the circuit of the winding of the electromagnet EM_2; the valve controlled by this electromagnet connects vacuum pump NV_1 to the vacuum system of the device. The contacts $3P_3$ open, preventing actuation of electromagnet EM_3. Contacts $4P_3$ allow capacitor C_2 of the time relay to charge. Contacts $6P_3$ close the power circuit to relay P_2 and it actuates. Contacts $1P_2$ block contacts $6P_3$, while contacts $2P_2$ connect anode voltage to the time relay.

Vacuum pump NV_1 creates vacuum in the instrument system. When the set vacuum is reached, the built-in valve 3 blocks the constant vacuum system 4 and reduced pressure is created only in measurement system 5.

When a vacuum of 400-405 mm Hg ("sample clamped" position of range switch S_1) or 485-490 mm Hg ("sample free" position of range switch S_1) is reached, contacts $1DS_1$, $2DS_1$ open the circuit of the winding of relay P_3. In addition, contacts $3DS_1$ and $4DS_1$ are interrupted and contacts $5P_3$ are disconnected; contacts $1P_3$ interrupt the power circuit of the winding of relay P_5, which switches the electric motor of vacuum pump NV_1.

In the first measurement range contacts $2P_3$ prepare the circuit of electromagnet EM_2 for disconnection, and in the second range they are disconnected, and the valve opened by this electromagnet disconnects the vacuum system of the instrument from vacuum pump NV_1.

Contacts $3P_3$ close the circuit of the electromagnet EM_3, and the valve controlled by it supports hermeticity of the vacuum system until the end of the test.

Contacts $4P_3$ disconnected the charge capacitor C_2 from the negative voltage source. Starting at this point the electronic relay begins to count time.

Contacts $6P_3$ open, but relay P_2 is held by the block contacts $1P_2$.

In the first range, as the vacuum falls to the set value, contacts $7DS_1$ open and switch off electromagnet EM_2, and the valve controlled by this electromagnet disconnects the vacuum system of the instrument from the vacuum pump NV_1.

At the end of 1 min after disconnection of relay P_3 relay P_4 actuates, the winding of which is connected to the anode circuit of lamp LS_1.

Contacts $1P_4$ close the power circuit of the winding of electromagnet EM_1; the valve controlled by this electromagnet connects the vacuum system of the instrument to atmosphere via the tested sample.

The contacts $2P_4$ prepare the circuit of relay P_1 for connection.

In the first and second range when the vacuum falls to the upper set value contacts $4DS_1$ ($3DS_1$) close the circuit of relay P_1.

Contacts $1P_1$ connect the motor SD_1 of counter $C4_1$ (not shown in the drawing) to the circuit, and contacts $2P_1$ connect the signal lamp LS_1, which indicates "sample test."

When the vacuum falls to the lower set value contacts $5DS_1$ ($6DS_1$) disconnect relays P_1 and P_2. Contacts $1P_1$ disconnect motor SD of counter $S4_1$, immobilizing its reading:

contacts $2P_3$ disconnect lamp LS_1;

contacts $1P_2$ prepare the circuit of the winding of relay P_2 for disconnection in the testing of the next sample;

contacts $2P_2$ remove the anode voltage from electron tube V_1 and relay R_4 is disconnected;

contacts $3P_2$ disconnect electromagnet EM_3; the valve controlled by this electromagnet opens under the effects of a spring and connects the measurement system to the constant vacuum system;

contacts $1P_4$ disconnect electromagnet EM_1; the valve, under the effect of vacuum, closes and disconnects the vacuum system of the instrument from the sample;

contacts $2P_4$ prepare the circuit of relay P_1 for the next test.

By rotating the handle of switch S_2 into the "sample free" position the contacts $S_{2\text{-}2}$ of electromagnet EM_2 are connected; the valve controlled by this electromagnet connects the vacuum system of the instrument to atmosphere.

The pressure in the system becomes equal to atmospheric and the sample is released.

After taking down the readings of the counter it is reset by zero by a lever.

The instrument is ready for the next test.

Claims

1. An instrument for determining the smoothness of paper by measuring the time for outflow of air between the surface of a polished stage and the tested sample of paper, which includes a stage, vacuum chamber connected to a pump by an air line, and a timing device, which is distinguished by the fact that, with the goal of stabilizing the set vacuum in the chamber and automating the measurement of the time of outflow of air, the vacuum chamber is connected to a pneumoelectric vacuum gauge and an electric timing device.

2. An instrument as in Claim 1, which is distinguished by the fact that a built-in valve is mounted on the air line between the gauge and the vacuum chamber.

//insert figure//